

## ***Anapalaeorchis hamajimai* gen. et sp. n. (Trematoda: Monorchiidae) from the Loach, *Cobitis biwae*, in Japan**

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**ABSTRACT:** *Anapalaeorchis hamajimai* gen. et sp. n. (Digenea: Monorchiidae: Asymphylodorinae) is described from gravid specimens from the digestive tract of a freshwater fish, *Cobitis biwae*, collected in the Tokigawa River, Saitama Prefecture, central Japan. *Anapalaeorchis* gen. n. is proposed for a species possessing ceca terminating midway in the hindbody, an acetabulum larger than the oral sucker, 2 tandem, nearly contiguous testes, a bipartite seminal vesicle, a trilobed ovary, and vitellaria in paired compact bunches.

**KEY WORDS:** *Anapalaeorchis* gen. n., *Anapalaeorchis hamajimai* sp. n., Digenea, Monorchiidae, Asymphylodorinae, *Cobitis biwae*.

In the course of examination of the digestive tract of the freshwater fish, *Cobitis biwae* Jordan and Snyder, taken from the Tokigawa River, Saitama Prefecture, central Japan, we found a monorchiid trematode with characters that did not agree with any existing genus. This trematode was found to be new and is here described as a new genus.

### **Materials and Methods**

A total of 128 specimens were collected from the digestive tract of the loach, *Cobitis biwae*, in the Tokigawa River, Saitama Prefecture, central Japan from 29 April 1985 to 27 August 1988. Of these, 46 gravid specimens were designated as type specimens. Descriptions and measurements were based on these specimens. The specimens were fixed in 70% ethanol under the pressure of a cover glass, stained with carmine, or eosin and hematoxylin, or only hematoxylin, and mounted. Measurements, given in micrometers unless otherwise stated, were made with the aid of a filar micrometer. The figure was drawn using a Nikon profile projector (6CT2). For scanning electron microscopy (SEM), worms and eggs were rinsed well with Ringer's saline and fixed for 4 hr in 5% glutaraldehyde in 0.1 M phosphate buffer (pH 7.3) and postfixed for 3 hr in phosphate-buffered osmium tetroxide. After dehydration with a graded series of ethanol, the specimens were dried in a critical point drying apparatus, coated with gold in a JEOL FC-1100 ion-sputtering apparatus, and photographed with a JEOL JSM-U3 scanning electron microscope operated at 15 kV.

### **Results**

#### ***Anapalaeorchis* gen. n.**

**DIAGNOSIS:** Body fusiform or spatulate, spinous. Oral sucker subterminal. Esophagus fairly long, slender. Ceca extending halfway through hindbody. Acetabulum circular, larger than oral sucker, in forebody. Testes double, tandem, nearly contiguous, ovoid to subtriangular, in hindbody.

Cirrus eversible, spined. Cirrus pouch claviform. Seminal vesicle bipartite, pars prostatica well differentiated. Ovary pretesticular, trilobed. Uterus filling space in hindbody. Terminal organ receiving metraterm terminally. Vitellaria laterally paired postacetabular compact bunches, equatorial.

**TYPE SPECIES:** *Anapalaeorchis hamajimai* sp. n.

#### ***Anapalaeorchis hamajimai* sp. n.** (Figs. 1-8)

**DESCRIPTION WITH CHARACTERS OF THE GENUS:** Body fusiform or spatulate, 910 (700-1,110) in length and 290 (240-330) in maximum width (Figs. 1-4); covered entirely with minute spines, which become thinner and smaller posteriorly (Figs. 5, 6). Oral sucker circular, subterminal, 122 (106-144) in diameter. Prepharynx not present. Pharynx oval, 65 (52-76) by 67 (58-79). Esophagus elongate, 205 (200-210) long. Ceca terminating at level of anterior testis or posterior end of ovary. Acetabulum greatly larger than oral sucker, 168 (132-199) by 162 (136-189), situated one-third of body length from anterior extremity; sucker width ratio, 1:1.3-1.4. Testes nearly touching, tandem; anterior testis ovoid to subtriangular, 104 (89-124) long by 90 (76-101) wide; posterior testis ovoid, elongate, 127 (87-145) long by 94 (69-110) wide. Cirrus eversible, spined. Cirrus pouch club-shaped, seminal vesicle bipartite, pars prostatica well differentiated. Ovary trilobed, 110 (79-143) long by 114 (73-162) wide, slightly posterior to middle of body, closely located to anterior testis. Genital pore near left margin of body, slightly anterior to level of posterior edge of acetabulum. Uterus sur-

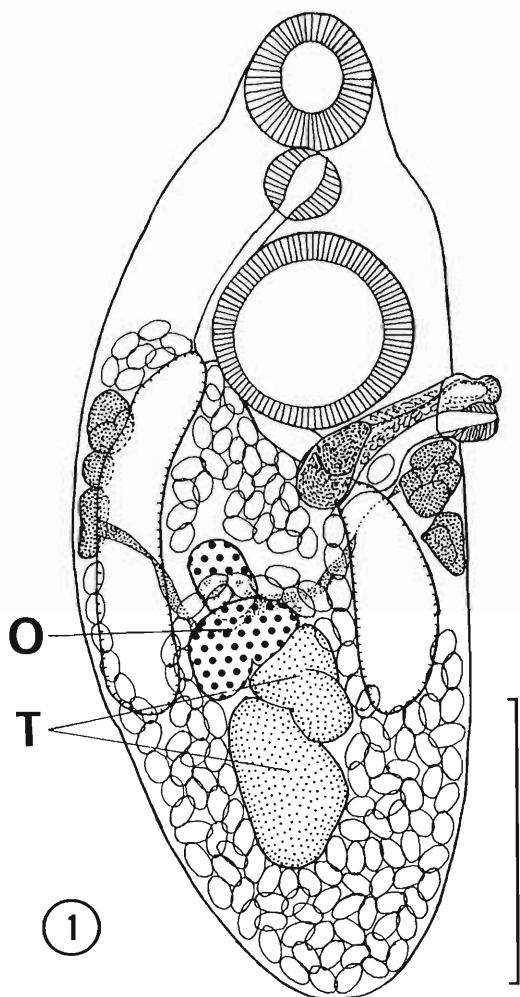


Figure 1. *Anapalaeorchis hamajimai*, holotype, ventral view. Bar = 200  $\mu$ m. O, ovary; T, testes.

rounding ovary and testes, filling hindbody. Vitellaria in lateral clusters of several follicles at midbody; right vitelline mass longer than left. Terminal organ receiving metraterm terminally. Eggs elliptical, operculate, embryonated, 29.3 (26.4–31.2)  $\times$  16.6 (15.4–17.2) ( $N$  = 100, live eggs) (Fig. 7). Egg shell surface coarse with shallow irregular pits or depressions (Fig. 8). Excretory system not observed.

**TYPE MATERIALS:** Holotype and 6 paratypes are deposited in the collection of the National Science Museum, Tokyo (NSMT, P1 3776); 4 paratypes in the United States National Museum Helminthological Collection (USNM Helm. Coll. No. 81141); 35 paratypes in the collection of the

Department of Parasitology, Faculty of Medicine, Kyushu University (PDKU T001–T035).

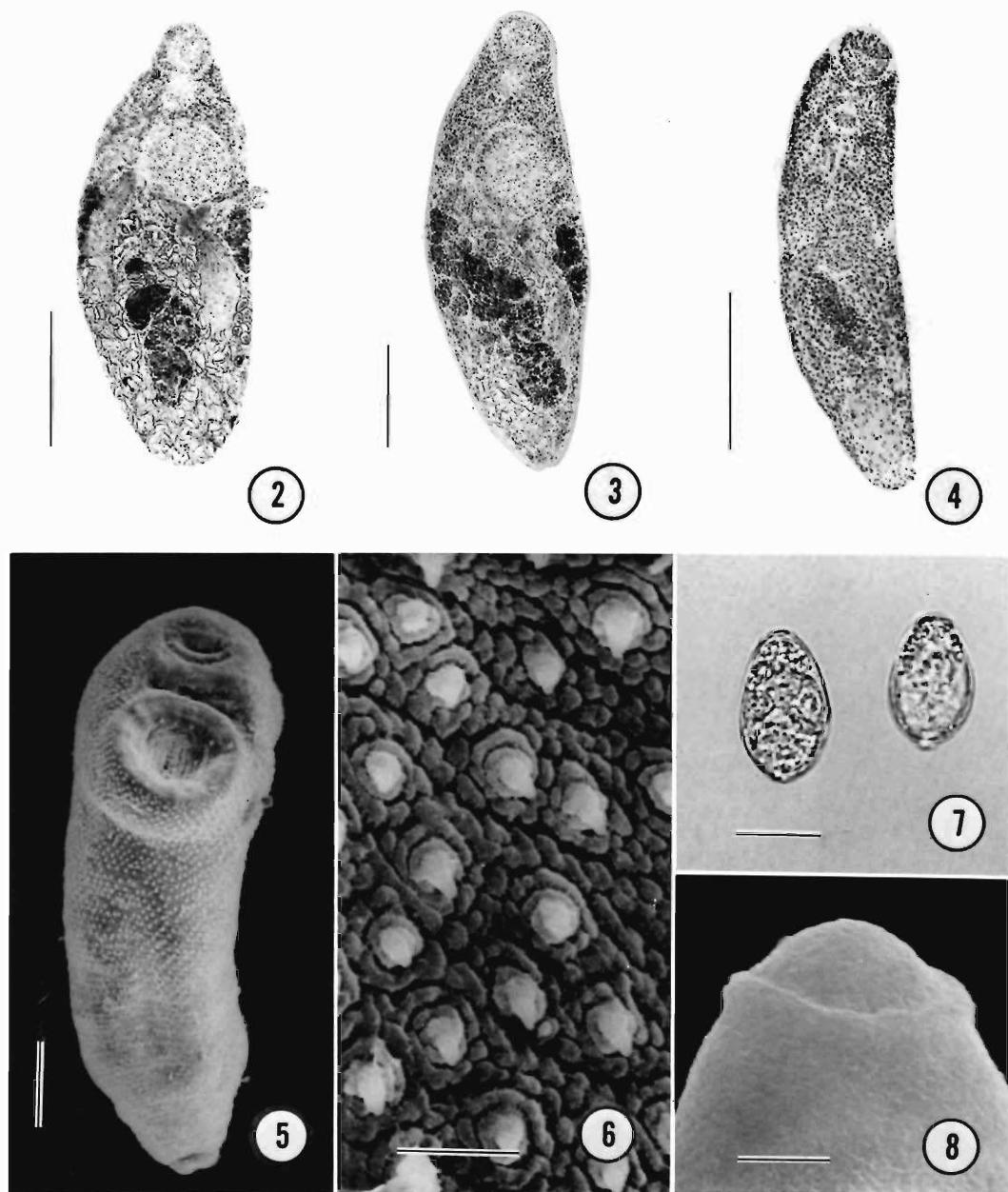
**HOST:** Sand loach, *Cobitis biwae* Jordan and Snyder.

**HABITAT:** Stomach (juvenile worms) and intestine (adult worms).

**ETYMOLOGY:** This species is named after Prof. Fusanori Hamajima who collected and donated the present material.

### Discussion

According to Yamaguti (1971), the monogeneid subfamily *Asymphylodoridae* includes 3 genera, *Palaeorchis* Szidat, 1943, *Asymphylodora* Looss, 1899, and *Triganodistomum* Simer, 1929. The new genus *Anapalaeorchis* is similar to *Palaeorchis* in that the double testes are unequal in size and the vitellaria are compact, but is easily separable in tandemly arranged testes, a trilobed ovary, and an acetabulum that is larger than the oral sucker. The testes of *A. hamajimai* are in tandem and almost touching, whereas all the species of *Palaeorchis* have testes that are juxtaposed and clearly separated. *Anapalaeorchis* is also similar to *Asymphylodora* in its large acetabulum and long esophagus. *Asymphylodora*, however, is different from *Anapalaeorchis* in having a single testis. Yamaguti (1938) erected a new species, *Asymphylodora japonica*, parasitic in the freshwater fish, *Cyprinus carpio*. He included some worms from the small intestine of *Cobitis biwae*, which were much smaller than those from *C. carpio*. We had the loan of Yamaguti's specimens from *Cobitis biwae* preserved in Meguro Parasitological Museum, Tokyo (No. 22034). Although these specimens mounted on 1 slide are too old to make sure whether the testis is single or separated, the specimens are found to have some features identifiable to *A. japonica*: the longer ceca extending over the posterior end of the testis and the more extended vitellaria than in *Anapalaeorchis hamajimai*. The main similarity of *Anapalaeorchis* to *Triganodistomum* is that in both genera the testes are arranged in tandem. The testes in *Triganodistomum*, however, are distinctly separated, whereas those of *Anapalaeorchis* are close to each other. The ceca reach to near the posterior extremity of the body in *Triganodistomum*, whereas the ceca terminate in the mid-hindbody in *Anapalaeorchis*. *Triganodistomum* has far more extensive vitellaria than has *Anapalaeorchis*.



Figures 2-8. 2-4. *Anapalaeorchis hamajimai*, H&E stain. Bar = 200  $\mu$ m. 2. Holotype, gravid adult. 3. Paratype, gravid adult. 4. Juvenile. 5, 6. *A. hamajimai*, SEM of body. 5. Whole body in ventral view. Bar = 50  $\mu$ m. 6. Tegumental spines, ventral aspect in middle region. Bar = 5  $\mu$ m. 7, 8. *A. hamajimai*, eggs. 7. Light micrograph of whole eggs. Bar = 20  $\mu$ m. 8. SEM of operculum and part of egg shell. Bar = 1  $\mu$ m.

Schell (1973) erected the genus *Neopaleorchis* based upon the new species, *N. catostomi*, which inhabits the intestine of a coarsescale sucker, *Catostomus macrocheilus*. *Anapalaorchis* bears superficial resemblance to *Neopaleorchis* in having tandem testes; however, in *Neopaleorchis*, the seminal vesicle is folded, but not bipartite, the oral sucker and acetabulum are nearly equal, vitellaria are postcecal and contiguous dorsal to uterus and testes, and eggs are small and numerous.

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